Third order shear deformation model for laminated shells with finite rotations: Formulation and consistent linearization

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Abstract: The paper presents an approach for the formulation of general laminated shells based on a third order shear deformation theory. These shells undergo finite (unlimited in size) rotations and large overall motions but with small strains. A singularity-free parametrization of the rotation field is adopted. The constitutive equations, derived with respect to laminate curvilinear coordinates, are applicable to shell elements with an arbitrary number of orthotropic layers and where the material principal axes can vary from layer to layer. A careful consideration of the consistent linearization procedure pertinent to the proposed parametrization of finite rotations leads to symmetric tangent stiffness matrices. The matrix formulation adopted makes the implementation of the present formulation within the framework of the finite element method as a straightforward task